

CLAIMS

1. A data transmission method for enclosed environments, such as a mine, the data transmission method being used in a data transmission system comprising one or more terminals (18) and a network (20) comprising at least one base station (17), a monitoring station (10 to 12) and a backbone network (15), the data transmission system having a radio connection between the terminal (18) and the base station (17) and a bi-directional connection from the monitoring station (10 to 12) to one or more working machines (19) via the terminals (18), each of which are coupled to a working machine (19), **characterized** in that data between the monitoring station (10 to 12) and the terminal (18) is transmitted digitally, and one or more working machines (19) are controlled from the monitoring station (10 to 12) by teleoperation substantially in real time by a deterministic data transmission protocol in which the data transmission delay is within predetermined limits.
2. A method as claimed in claim 1, **characterized** in that the network (20) operates on the multicasting principle, whereby transmitted messages are forwarded to more than one units connected to the network.
3. A method as claimed in claim 1, **characterized** in that data transmission is performed in the network (20) as in an ATM network.
4. A method as claimed in claim 3, **characterized** in that the ATM network (20) operates on the multicasting principle by the ATM switches (14) operating independently without control.
5. A method as claimed in claim 3, **characterized** in that the ATM network (20) operates on the multicasting principle so that the ATM switches (14) are under centralized control.
6. A method as claimed in claim 1, **characterized** in that transmitted messages are forwarded to all units connected to the network.
7. A method as claimed in claim 1, **characterized** in that a connection between the terminal (18) and the base station (17) is established by wireless spread spectrum signalling.
8. A method as claimed in claim 1, **characterized** in that data is transmitted in broadband, and in data transmission one or more of the following information types are transmitted substantially simultaneously: image, voice, data.
9. A method as claimed in claim 8, **characterized** in that in

data transmission image, voice and data are transmitted in packets.

10. A method as claimed in claim 8, **characterized** in that each terminal (18) has a fixed data transmission band, which in data transmission is allocated to image, voice and data.

5 11. A method as claimed in claim 8, **characterized** in that image and/or voice are compressed for data transmission.

12. A method as claimed in claim 11, **characterized** in that image is dynamically compressed.

10 13. A method as claimed in claim 1, **characterized** in that in data transmission logical connections are established between the units by a graphic user interface.

15 14. A data transmission system to be used in enclosed environments, such as a mine, the data transmission system comprising one or more terminals (18) and a network (20) comprising at least one base station (17), a monitoring station (10 to 12) and a backbone network (15), the data transmission system having a radio connection between the base station (17) and the terminal (18) and a bi-directional connection from the monitoring station (10 to 12) to one or more terminals (18) which are coupled to a working machine (19), **characterized** in that the data transmission system is arranged to
20 transmit data digitally between the monitoring station (10 to 12) and the terminal (18), and the data transmission system comprises a deterministic data transmission protocol by which one or more working machines (19) can be controlled by teleoperation substantially in real time and in which the data transmission delay is within predetermined limits.

25 15. A data transmission system as claimed in claim 14, **characterized** in that the network (20) is arranged to operate on the multicasting principle, whereby transmitted messages are forwarded to substantially all units connected to the network.

30 16. A data transmission system as claimed in claim 14, **characterized** in that the network (20) is substantially an ATM network.

17. A data transmission system as claimed in claim 16, **characterized** in that the ATM network (20) is arranged to operate on the multicasting principle, whereby the ATM switches (14) operate independently without separate control.

35 18. A data transmission system as claimed in claim 16, **characterized** in that the ATM network (20) is arranged to operate on the multi-

casting principle, whereby the ATM switches (14) can be controlled in a centralized manner.

5 19. A data transmission system as claimed in claim 14, **characterized** in that the data transmission system is arranged to forward transmitted messages in a restricted manner to one or more units connected to the network.

10 20. A data transmission system as claimed in claim 14, **characterized** in that the data transmission system is arranged to establish a connection between the terminal (18) and the base station (17) by wireless spread spectrum signalling.

15 21. A data transmission system as claimed in claim 14, **characterized** in that the data transmission system is arranged to perform data transmission in broadband, and that in data transmission the data transmission system is arranged to transmit substantially simultaneously one or more of the following information types: image, voice, data.

22. A data transmission system as claimed in claim 21, **characterized** in that in data transmission the data transmission system is arranged to transmit image, voice and data in packets.

20 23. A data transmission system as claimed in claim 21, **characterized** in that each terminal has a fixed data transmission band which the data transmission systems is arranged to allocate in data transmission to image, voice and data.

25 24. A data transmission system as claimed in claim 21, **characterized** in that the data transmission system is arranged to compress image and/or voice for data transmission.

25. A data transmission system as claimed in claim 24, **characterized** in that the data transmission system is arranged to compress image dynamically.

30 26. A data transmission system as claimed in claim 14, **characterized** in that the data transmission system is arranged to establish logical connections between the units by a graphic user interface.